

**Surface Water Monitoring
and Assessment
1997 Lake Ontario Report
Featuring a Summary of Tributary
and Nearshore Conditions and Trends
for the Lake Ontario Basin**

November 1999



**Ministry of the
Environment**

Surface Water Monitoring and Assessment 1997 Lake Ontario Report

Featuring a Summary of Tributary
and Nearshore Conditions and Trends
for the Lake Ontario Basin


Prepared by:
Environmental Monitoring and Reporting Branch

November 1999

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Foreword

The *Surface Water Monitoring and Assessment 1997 Lake Ontario Report* has been prepared to summarize the range of recent surface water monitoring work undertaken by the Environmental Monitoring and Reporting Branch. The introductory material provides an overview of the various programs supported by the Branch and is followed by a summary of selected recent water quality results and trends. Lake Ontario was the focus of 1997/98 ambient monitoring in the Great Lakes, and consequently this Annual Report highlights results from Lake Ontario tributary and nearshore monitoring. Subsequent Annual Reports will focus on different Lake Basins according to the lake-by-lake monitoring cycle described in this document.

The initial overview is intended to provide program managers within the Ministry, as well as other Provincial and Federal agencies, with basic information concerning the current surface water monitoring database and mandate of the Branch. The summary of selected data is provided to illustrate the range of information available to anyone interested in water quality issues. The intention is to allow interested readers to pursue details pertaining to their particular area of interest, whether they represent provincial, federal, or municipal agencies, universities, or consultants. By making this summary widely available we are also endeavouring to improve access to technical information and staff within the Branch. Given the wide range of environmental issues and challenges in the Great Lakes Basin, such access is essential for internal and external program coordination, and the provision of timely and effective client services.

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1.0 Surface Water Monitoring Program Summary

As described in the MOE Business Plan, the provincial commitment to Environmental Protection includes “*Improving Water Quality*” as a Core Business goal. The Ministry’s surface water quality management goals associated with this Core Business are to ensure that (a) the quality of surface water is protected to ensure a healthy aquatic ecosystem; and (b) drinking water supplies are safe and aesthetically pleasing. Surface water quality management in Ontario is guided by a range of policies which outline the manner in which the Ministry will apply and enforce the appropriate aspects of environmental legislation (including the Environmental Protection Act, Ontario Water Resources Act, and the Environmental Assessment Act). Three of these policies are directly applicable to water quality monitoring:

Policy 1:

In areas which have water quality better than Provincial Water Quality Objectives (PWQOs), water quality shall be maintained at or above the Objectives;

Policy 2:

Water Quality which presently does not meet the PWQOs will not be degraded further and all practical measures will be taken to upgrade the water quality to the Objectives; and

Policy 5:

Mixing zones [areas contiguous to a pollution source where the water quality fails to comply with one or more of the PWQOs] should be as small as possible and not interfere with beneficial uses. Mixing zones are not to be used as an alternative to reasonable and practical treatment.

These Policies require an understanding of the prevailing water quality status as the basis for regulatory decisions (e.g. issuance of a Certificate of Approval). In addition to these policies, the Ministry publication *Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters* stresses the importance of background physical, chemical, and biological conditions in developing receiving-water based effluent requirements.

The current surface water ambient monitoring program administered by the Environmental Monitoring and Reporting Branch (EMRB) includes three general components: River Systems Monitoring and Assessment, Great Lakes Nearshore Monitoring and Assessment, and Inland Lake Monitoring (which is undertaken in partnership with Cottagers Associations through the Lake Partner Program and is reported separately).

1.1 River Systems Monitoring and Assessment

The River Systems Monitoring and Assessment Program provides measurement and assessment of water quality and stream flow in rivers and streams throughout Ontario. Water quality and flow information is used to track long term (>20 years) and recent trends, to map spatial patterns across watersheds with differing land-use characteristics, and for the environmental planning and approvals process.

The core program includes the following:

1.1.1 Provincial Water Quality Monitoring Network (PWQMN)

Water quality sample collections are undertaken across the province at approximately 200 sites in partnership with MOE Regional Technical Assessment Units and local Conservation Authorities. Samples are currently collected at approximately monthly intervals from April through November and are analysed for a range of water quality indicators (including temperature, pH, conductivity, turbidity, suspended solids, major ions, nutrients, and metals) in order to screen overall water quality and identify potentially anomalous results.

1.1.2 Enhanced Tributary Monitoring Program (ETMP)

Since 1980 samples have been collected near the mouths of 16 strategically chosen watersheds throughout the Great Lakes Basin representing approximately 50% of the total flow into the Great Lakes from Canadian watersheds. The program tracks long term changes in water quality and contaminant loadings. Currently, approximately 20 samples per year are collected at each station with an emphasis on the spring freshet which typically accounts for a significant proportion of annual contaminant loadings. Samples are analysed for the same parameters as the PWQMN samples with additional analysis for trace organics (e.g. PCBs and organochlorine pesticides, and other in-use pesticides at selected locations). Results from this program provide a means of assessing spatial and temporal trends in water quality and contaminant loadings among and within major watersheds, and allow the screening of potential “problem” watersheds. This activity also supports the Provincial commitment to the Great Lakes Water Quality Agreement (GLWQA) of the International Joint Commission (IJC).

1.1.3 Streamflow Network

Hydrometric data are fundamental to the information required by MOE for water quality assessments, pollutant loading computations, discharge approvals, issuing of *Permits to Take Water*, resolution of interference complaints, and policy and standards development. Presently there are about 325 stations in the Ontario network. A 1975 Agreement between Canada and Ontario regarding hydrometric surveys in the province includes MOE as a signatory. Environment Canada acts on behalf of the federal government as both a partner and operator of the network while the Ministry of Natural Resources is the major partner acting on behalf of the province of Ontario. The purpose of the agreement is to provide a coordinated, standardized and cost shared approach to the collection of streamflow data. Under the terms of the Agreement, the provision of partial annual funding for the operation and maintenance of the network gives MOE access to all collected hydrometric data.

1.2 Great Lakes Nearshore Monitoring and Assessment Program

This program is designed to measure environmental indicators related to toxics, nutrients, microorganisms, and exotic species in the nearshore areas of the Great Lakes and connecting channels. It also provides assessments of site-specific environmental problems, and effectiveness of remedial and abatement activity in nearshore areas, harbours and embayments (including “Areas of Concern” identified to the International Joint Commission). In addition to meeting internal MOE information requirements, this program also supports the Provincial commitment to the Great Lakes Water Agreement of the International Joint Commission (as described through the Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem).

Core elements of ambient monitoring are undertaken on a lake-by-lake basis over a multi-year cycle so as to provide good spatial coverage of the Great Lakes while maintaining an acceptable level of sampling frequency for most data uses. A periodic sampling cycle that allows for a greater intensity of sampling in Lakes Ontario and Erie (the lake basins under greatest stress) is guiding the field schedule presently for most of the program elements. The current planned cycle is as follows:

Year	Lake Basin/Connecting Channel Unit
1997	Lake Ontario, St. Lawrence River, Niagara River
1998	Lake Erie, Detroit River, Lake St.Clair, St.Clair River
1999	Lake Superior, St. Marys River, North Channel
2000	Lake Ontario, St. Lawrence River, Niagara River
2001	Lake Erie, Detroit River, Lake St.Clair, St.Clair River
2002	Lake Huron, Georgian Bay

The core nearshore monitoring and assessment program includes the following elements:

1.2.1 Great Lakes Index Station Monitoring

"Index" and "reference" stations are located in areas representative of background conditions and in areas where there is a natural integration of the stressors from a larger area. Fifty-seven core sites (*see map*) have been established throughout the Great Lakes basin and a minimum of seven sites are visited within a lake basin each year according to the lake-by-lake cycle. This network of stations is designed to provide information on where and how water quality conditions are changing over time by periodically monitoring a suite of environmental indicators. Sampling is undertaken for summer concentrations of priority toxic contaminants in sediment and suspended particulate material as an indicator of the level of priority contaminants present in the aquatic environment. Summer species composition and abundance of benthic invertebrates are monitored as a biological indicator of overall ecosystem health and as a general stress response indicator. Spring, summer, and fall sampling is undertaken for various physical measurements including thermal and optical profiles of the water column, and physical characterization of the lake bottom as indicators of habitat integrity.

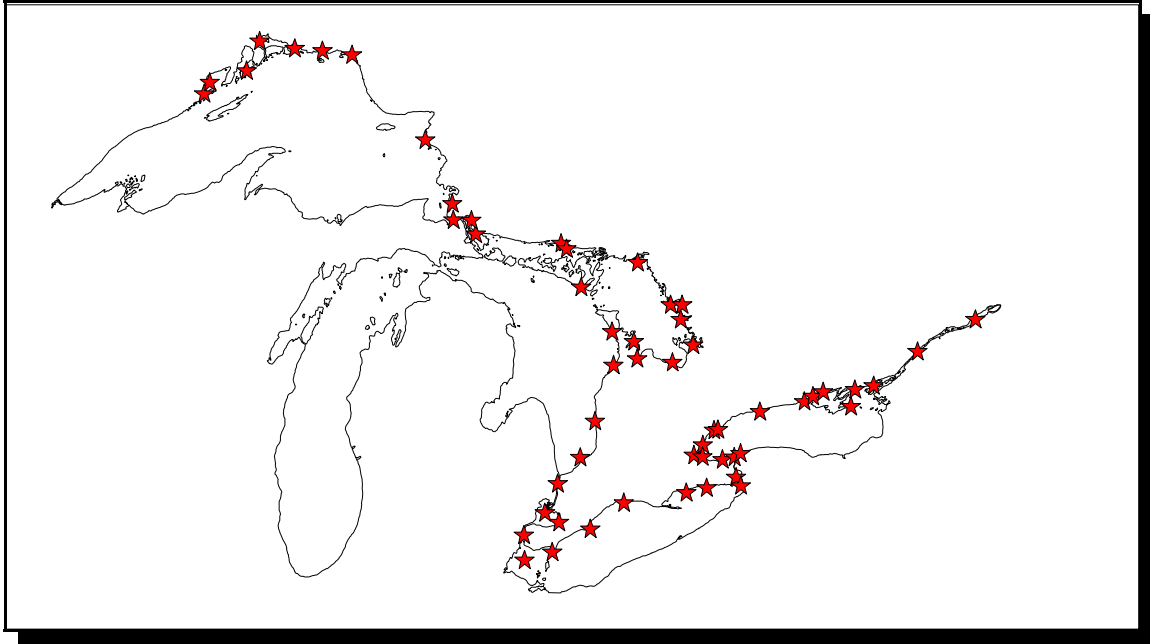


Figure 1.2.1: Index and Reference Monitoring Locations

1.

2.2 Great Lakes Reconnaissance Monitoring

Reconnaissance monitoring is designed to identify the status of environmental indicators in the immediate nearshore zone most strongly and directly affected by land-based activities and is undertaken in two parts. The first involves “real-time” mapping of nutrient, bacteriological, physical and aesthetic features of water quality along selected ranges of shoreline. The second, Harbour Water Quality Screening, involves more extensive sampling at a limited number of key sites (frequently within the above survey areas) where water quality conditions at sites are known to be impacted, or, have a potential for impact. Additional sampling for trace contaminants and sediment quality is conducted at these stations to enable calculation of various water and sediment quality indices. Data are compared with Provincial Water Quality Objectives (PWQOs) and Provincial Sediment Quality Guidelines (PSQGs) to screen harbours and embayments (including those which have not been the traditional focus of attention by the IJC) for sources of pollutants such as municipal and industrial effluent discharges, and historical accumulations in sediment.

1.2.3 Great Lakes Toxics Biomonitoring

Long-term monitoring of contaminant levels in mussels, zebra mussels, juvenile fish, and selected sport fish is undertaken to track levels of toxic contaminants (i.e. persistent, bioaccumulative substances) through time across the Great Lakes. Sport fish results reflect the long-term, spatially integrated effects of exposure to persistent bioaccumulative substances (e.g. PCBs, dioxins/furans) and provide a superior means of tracking long-term trends over the basin as a whole. They also form the basis of the *Guide to Eating Ontario Sport Fish*. Mussel and juvenile fish data, on the other hand, provide a means of identifying problem zones and potential contaminant sources and assessing the corresponding long term trends.

1.2.4 Great Lakes Tributary Toxics Monitoring

This sampling is intended to identify those tributaries with significant concentrations and loadings of persistent bioaccumulative substances to each of the Great Lakes on an annual lake-by-lake cycle. A combination of biomonitoring, flow monitoring, and temporally integrated large-volume sampling for trace organics (PCB congeners, organochlorines, chlorobenzenes, PAHs), physical parameters, nutrients, and metals is employed.

1.2.5 Great Lakes Water Intake Biomonitoring

Water intake biomonitoring is undertaken to identify long term trends in nutrient status using year-round (weekly-monthly) nutrient concentrations and phytoplankton biomass as indicators. Monitoring has been ongoing for more than 20 years from raw intake water at 18 water treatment plants that draw water from the Great Lakes. Six of these are situated in Lake Ontario (see Map). Results are used to assess the effectiveness of nutrient management programs in the Great Lakes. A secondary benefit of this monitoring data is that it may provide an indication of effects from a variety of stressors not actively monitored in the aquatic environment (e.g. climate change).

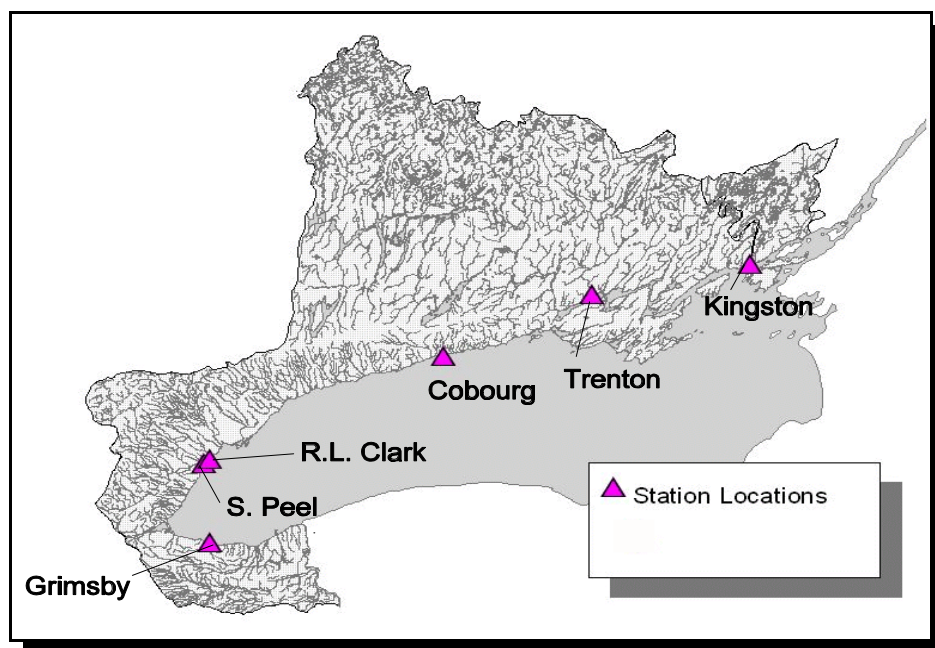


Figure 1.2.2: Water Intake Monitoring Locations in Lake Ontario

1.3 Investigations and External Services

There remains an ongoing need for a number of site/area assessment surveys specifically designed to examine the extent and nature of site-specific environmental impacts of known contaminant sources and other anthropogenic stressors. These investigative surveys are frequently undertaken at the request of Operations Division, often as part of the federal-provincial Remedial Action Plan program. These types of investigations are integrated with the core ambient monitoring activity survey schedule if this can be accomplished without compromising the quality of service to Operations Division. Otherwise, requests are dealt with case-by-case. Depending upon the nature and complexity of the work, results from these projects are reported in Technical Memoranda or more detailed reports. Examples of these investigations in recent years include:

Year(s)	
1995 and 1996	Toronto Sediment and Benthos Monitoring
1995 and 1996	Thunder Bay (Northern Wood Preservers) Investigation
1996	St. Clair River and Detroit River Juvenile Fish Monitoring
1996 and 1997	St. Lawrence River Juvenile Fish Monitoring
1996 - 1998	Niagara River Juvenile Fish Monitoring
1996 - 1998	Bay of Quinte Phytoplankton Investigation
1996 and 1997	Belleville Waterfront Sediment Investigation
1996 and 1997	Port Dalhousie Harbour Sediment and Biomonitoring Investigation
1996	Owen Sound Coal Tar Sediment Investigation
1996	St. Clair River, Dow Cleanup Monitoring
1996	Toronto Eastern Beaches Tank Monitoring
1996	Welland River Sediment and Benthic Investigation
1996	Port Dalhousie Sediment Investigation
1996 - 1998	Severn Sound Water Quality Analysis and Sediment Survey
1997	Cornwall Sediment Survey
1998	Wheatley Harbour RAP Survey
1998	LaCloche Channel Aquaculture Survey